

**Claims:**

1. A method for determining a state-of-charge of a battery, **characterized in that**  
 5 a transition frequency ( $f_{\pm}$ ) of an impedance (Z) is evaluated for a battery (40), which is excited by an alternating current, and the transition frequency ( $f_{\pm}$ ) is assigned to the state-of-charge of the battery (40), whereby the transition frequency ( $f_{\pm}$ ) is a frequency of the alternating current at which the imaginary part ( $Z''$ ) of the impedance (Z) of the battery (40) vanishes.  
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2. The method according to Claim 1, **characterized in that** the battery (40) is excited by noise signals which are generated by the loads (10) in the power net which comprises the battery (40), and/or by an alternating current source (20) contained in the power net.  
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3. The method according to one or both of Claims 1 and 2, **characterized in that** the alternating voltage drop at the battery (40) is measured.
4. The method according to one or more of the preceding Claims,  
 20 **characterized in that** the intensity of the alternating current flowing through the battery (40) is measured.
5. The method according to one or more of the preceding Claims,  
 25 **characterized in that** a phase difference between a phase of an alternating voltage and a phase of alternating current is determined.
6. The method according to one or more of the preceding Claims  
 30 **characterized in that** the transition frequency ( $f_{\pm}$ ) of the alternating current, at which the phase difference between the phase of the alternating voltage and the phase of the alternating current vanishes, is determined.

7. The method according to one or more of the preceding Claims  
**characterized in that** the complex impedance ( $Z$ ) of the battery (40) is determined.
- 5 8. The method according to one or more of the preceding Claims,  
**characterized in that** the frequency ( $f_{\pm}$ ) of the alternating current, at which  
an imaginary part of the complex impedance ( $Z$ ) vanishes, is determined.
- 10 9. The method according to one or more of the preceding Claims,  
**characterized in that** a frequency ( $f$ ) of the alternating current, exciting the  
battery (40), is varied.
- 15 10. The method according to one or more of the preceding Claims  
**characterized in that** an operating temperature of the battery (40) is taken  
into consideration in the assignment of the transition frequency ( $f_{\pm}$ ) to the  
state-of-charge (SOC).
- 20 11. The method according to one or more of the preceding Claims,  
**characterized in that** an intensity of a direct current flowing through the  
battery (40) is taken into consideration in the assignment of the transition  
frequency ( $f_{\pm}$ ) to the state-of-charge (SOC).
- 25 12. The method according to one or more of the preceding Claims,  
**characterized in that** an aging status of the battery (40) is taken into  
consideration in the assignment of the transition frequency ( $f_{\pm}$ ) to the state-  
of-charge (SOC).
- 30 13. The method according to one or more of the preceding Claims,  
**characterized in that** an aging status of the battery (40) is determined.
14. A device for determining a state-of-charge of a battery, **characterized in  
that** it comprises a means for the determination of a transition frequency ( $f_{\pm}$ )

of an impedance ( $Z$ ) of a battery (40), which is excited by an alternating current, and a calculation unit (120) for the assignment of the transition frequency ( $f_{\pm}$ ) to the state-of-charge of the battery (40), where the transition frequency ( $f_{\pm}$ ) is a frequency of the alternating current at which the imaginary part ( $Z''$ ) of the impedance ( $Z$ ) of the battery (40) vanishes.

15. The device according to Claim 14, **characterized in that** it comprises a variable alternating current source (30).

16. The device according to one or both Claims 14 and 15 **characterized in that** the means for the determination of the transition frequency ( $f_{\pm}$ ) comprises a sensor (50) for the measurement of an alternating voltage drop at the battery (40).

17. The device according to one or more of Claims 14 to 16, **characterized in that** the means for the determination of the transition frequency ( $f_{\pm}$ ) comprises a sensor (50) for the measurement of the intensity of an alternating current flowing through the battery (40).

18. The device according to one or more of Claims 14 to 17, **characterized in that** that the means for the determination of the transition frequency ( $f_{\pm}$ ) comprises at least a variable frequency filter (80, 90, 150) for filtering the measured current and voltage signals.

19. The device according to one or more of Claims 14 to 18, **characterized in that** the means for the determination of the transition frequency ( $f_{\pm}$ ) comprises a phase comparator (100), which determines the phase difference between the filtered current and voltage signals.

20. The device according to one or more of Claims 14 to 19, **characterized in that** the means for the determination of the transition frequency ( $f_{\pm}$ ) comprises a control unit (110), which scrutinizes the phase difference and

modifies a transmitted frequency of the frequency filter (80, 90) and/or a frequency of the alternating current source (30), till the phase difference is null.

- 5 21. The device according to one or more of Claims 14 to 20, **characterized in that** the means for the determination of the transition frequency ( $f_{\pm}$ ) comprises a means (160) for the Fourier Transformation of the measured current and voltage signals.
- 10 22. The device according to one or more of Claims 14 to 21, **characterized in that** the means for the determination of the transition frequency ( $f_{\pm}$ ) comprises an analysis unit (170) for analysing the transformed signals and determining a frequency for which an imaginary part ( $Z''$ ) of an impedance ( $Z$ ) of the battery (40) vanishes.
- 15 23. The device according to one or more of Claims 14 to 22, **characterized in that** it comprises a sensor (70) for measuring an operating temperature of the battery (40).
- 20 24. The device according to one or more of Claims 14 to 23, **characterized in that** it comprises a sensor (60) for measuring the intensity of a direct current flowing through the battery (40).
- 25 25. The device according to one or more of Claims 14 to 24, **characterized in that** the calculation unit (120) comprises calculation specifications for the assignment of the transition frequency ( $f_{\pm}$ ) to the state-of-charge of the battery (40) for several operating temperatures of the battery (40).
- 30 26. The device according to one or more of Claims 14 to 25, **characterized in that** the calculation unit (120) comprises calculation specifications for the assignment of the transition frequency ( $f_{\pm}$ ) to the state-of-charge of the

battery (40) for several intensities of the direct current flowing through the battery (40).

5        27. The device according to one or more of Claims 14 to 26, **characterized in that** the calculation unit (120) comprises calculation specifications for the assignment of the transition frequency ( $f_{\pm}$ ) to the state-of-charge of the battery (40) for several aging status of the battery (40).

10       28. The device according to one or more of Claims 14 to 27, **characterized in that** it comprises a display device (130) for displaying the state-of-charge (SOC) of the battery.